

IN THE CLAIMS

Please amend the claims to read as follows:

Listing of Claims

1. (Cancelled).

2. (Currently Amended) ~~An image processing method according to claim 1, wherein said~~ An image processing method comprising:

gradation modulating a multi-tone image to produce a processed image, wherein:

a dot arrangement of the processed image is a mixture of a periodic dot output region and a non-periodic dot output region, and

the periodic dot output region is an intermediate and or high thickness region of the multi-tone image.

3. (Currently Amended) ~~An image processing method according to claim 1, wherein said~~ An image processing method comprising:

gradation modulating a multi-tone image to produce a processed image, wherein:

a dot arrangement of the processed image is a mixture of a periodic dot output region and a non-periodic dot output region, and

the non-periodic dot output region is a low thickness region of the multi-tone image.

4. (Currently Amended) ~~An image processing method according to claim 1, wherein said~~ An image processing method comprising:

gradation modulating a multi-tone image to produce a processed image, wherein:

a dot arrangement of the processed image is a mixture of a periodic dot output region and a non-periodic dot output region, and

the non-periodic dot output region is an edge portion of the multi-tone image.

Claims 5 and 6 (Cancelled).

7. (Currently Amended) ~~An image processing method according to claim 5, wherein~~ An image processing method comprising:

gradation modulating a multi-tone image to produce a processed image, wherein:

a dot arrangement of the processed image is a mixture of a periodic dot output region and a non-periodic dot output region,
an error diffusion method or a mean error minimization method is applied to the periodic dot output region and the non-periodic dot output region, and

error weighting coefficients, that are used for error propagation of error in said error diffusion method or said mean error minimization method, that are applied to said periodic dot output thickness region are different from those used for propagation of error in said error diffusion method or said mean error minimization method applied to said non-periodic dot output thickness region.

8. (Currently Amended) ~~An image processing method according to claim 1, wherein the~~ An image processing method comprising:

gradation modulating a multi-tone image to produce a processed image, wherein:

a dot arrangement of the processed image is a mixture of a periodic dot output region and a non-periodic dot output region,
and

the dots generated in said periodic dot output thickness region are of a dot concentrated type.

9. (Cancelled).

10. (Currently Amended) ~~An image processing method according to claim 1, wherein the~~ An image processing method comprising:

gradation modulating a multi-tone image to produce a processed image, wherein:

a dot arrangement of the processed image is a mixture of a periodic dot output region and a non-periodic dot output region,
and

error weighting coefficients used for error propagation of error in the an error diffusion method or a mean error minimization method applied to said periodic dot output thickness region do not take the a maximum value for a pixel nearest to the a pixel of interest.

11. (Cancelled).

12. (Currently Amended) ~~An image processing apparatus according to claim 11, further comprising~~ An image processing apparatus comprising:

a decision means for deciding whether the dot arrangement of said image after said gradation modulation a multi-tone image includes said a periodic or non-periodic dot arrangement; and output region or said non-periodic dot output region

a gradation modulating means for gradation modulating the multi-tone image to produce a dot arrangement for a processed image that is a mixture of a periodic dot output region and a non-periodic dot output region.

13. (Currently Amended) An image processing apparatus according to claim ~~11~~ 12, further comprising:

a means for storing a first threshold matrix for said periodic dot output region;

a means for storing a second threshold matrix for said non-periodic dot output region; and

a means for selecting either one of said the first threshold matrix for said periodic dot output and said or the second threshold matrix for said non-periodic dot output in accordance with the a decision result from said decision means according to claim 12.

14. (Currently Amended) An image processing apparatus according to claim ~~11~~ 12, further comprising:

~~a means for making propagation of~~ propagating an error by through an error diffusion method or a mean error minimization method;

~~a means for storing~~ first error weighting coefficients for said periodic dot output ~~region;~~

~~a means for storing~~ second error weighting coefficients for said non-periodic dot output ~~region;~~ and

~~a means for selecting either one of said error weighting coefficients for said periodic dot output and said error weighting coefficients for said non-periodic dot output~~ the first or second error weighting coefficients in accordance with the a decision result from said decision means according to claim 12.

15. (Currently Amended) ~~An image processing apparatus according to claim 11, further comprising~~ An image processing apparatus comprising:

~~a detection means for detecting an edge portion in said received~~ a multi-tone image; and

~~a gradation modulating means for gradation modulating the multi-tone image to produce a dot arrangement for a processed image that is a mixture of a periodic dot output region and a~~

non-periodic dot output region in accordance with detection results of the detection means.

16. (New) An image processing apparatus comprising:

an image data acquiring unit that acquires pixel data from image data having a plurality of colors;

a thickness region decision unit that decides whether the pixel data acquired by said image data acquiring unit includes pixels at a thickness region having a thickness lower than a predetermined value or includes pixels at a thickness region having a thickness equal to or higher than the predetermined value; and

an image output unit that outputs, responsive to the decision of said thickness region decision unit, an arrangement of pixels non-periodically when the pixel data includes pixels at a thickness region having a thickness lower than the predetermined value and outputs an arrangement of pixels periodically when the pixel data includes pixels at a thickness region having a thickness equal to or higher than the predetermined value.

17. (New) An image processing apparatus according to claim 16, further comprising:

a dot arrangement decision unit that decides, responsive to the decision of said thickness region decision unit, that pixels are arranged non-periodically when the pixel data includes pixels at a thickness region having a thickness lower than the predetermined value and that pixels are arranged periodically when the pixel data includes pixels at a thickness region having a thickness equal to or higher than the predetermined value, wherein

said image output unit outputs, responsive additionally to the decision of said dot arrangement decision unit, the arrangement of pixels decided by the dot arrangement decision unit.

18. (New) An image processing apparatus according to claim 16, further comprising:

a dot arrangement decision unit that decides, responsive to the decision of said thickness region decision unit, that pixels are arranged non-periodically when the pixel data includes pixels at a thickness region having a thickness lower than the predetermined value and that pixels are arranged periodically when the pixel data includes pixels at a thickness region having a thickness equal to or higher than the predetermined value;

a periodic dot output threshold storage unit that stores a periodic dot output threshold value when dots are arranged periodically;

a non-periodic dot output threshold storage unit that stores a non-periodic dot output threshold value when the dots are arranged non-periodically;

a threshold matrix selecting unit that selects, responsive to the decision of said dot arrangement decision unit, one of the periodic dot output threshold value stored in said periodic dot output threshold storage unit and the non-periodic dot output threshold value stored in said non-periodic dot output threshold storage unit;

a periodic dot output diffusion coefficient storage unit that stores a periodic dot output diffusion coefficient when the dots are arranged periodically;

a non-periodic dot output diffusion coefficient storage unit that stores a non-periodic dot output diffusion coefficient when the dots are arranged non-periodically;

a diffusion coefficient selecting unit that selects, responsive to the decision of said dot arrangement decision unit, one of the periodic dot output diffusion coefficient stored in said periodic dot output diffusion coefficient storage unit and

the non-periodic dot output diffusion coefficient stored in said non-periodic dot output diffusion coefficient storage unit; and

an error diffusion computing unit that computes an error diffusion from the diffusion coefficient selected by said diffusion coefficient selecting unit and performs binary processing based on the threshold value selected by said threshold matrix selecting unit, wherein

said image output unit outputs, responsive additionally to an output from said error diffusion computing unit, the arrangement of pixels decided by the dot arrangement decision unit.

19. (New) An image processing apparatus according to claim 18, further comprising:

an error calculation unit that calculates an error produced, when the binary processing is performed, from: (1) binary-processed pixel data calculated by said error diffusion computing unit and (2) the image data acquired pixel by pixel by said image data acquiring unit, wherein

said error diffusion computing unit computes the error diffusion of the image data from: (1) error data calculated by the error calculation unit, (2) the diffusion coefficient selected by said diffusion coefficient selecting unit, and (3)

the threshold value selected by said threshold matrix selecting unit.

20. (New) An image processing apparatus according to claim 16, further comprising an edge detection unit that decides whether or not multi-tone image data acquired by said image data acquiring unit includes pixels at an edge region.

21. (New) An image processing apparatus comprising:

an image data acquiring unit that acquires pixel data from image data having a plurality of colors;

an edge detection unit that decides whether or not the pixel data acquired by said image data acquiring unit includes pixels at an edge region; and

an image output unit that outputs, responsive to the decision of said edge detection unit, an arrangement of pixels non-periodically when the pixel data includes pixels at the edge region.

22. (New) An image processing apparatus according to claim 21, further comprising:

a thickness region decision unit that decides, responsive to the decision of said edge detection unit, whether the pixel data

includes pixels at a thickness region having a thickness lower than a predetermined value or includes pixels at a thickness region having a thickness equal to or higher than the predetermined value, when the pixel data includes pixels that are out of the edge region, wherein

said image output unit outputs, responsive to the decision of said thickness region decision unit, an arrangement of pixels non-periodically when the pixel data includes pixels at a thickness region having a thickness lower than the predetermined value and outputs an arrangement of pixels periodically when the pixel data includes pixels at a thickness region having a thickness equal to or higher than the predetermined value.

23. (New) An image processing apparatus comprising:

an image data acquiring unit that acquires pixel data from image data having a plurality of colors;

a thickness region decision unit that decides whether the pixel data acquired by said image data acquiring unit includes pixels at a thickness region having a thickness lower than a predetermined value or includes pixels at a thickness region having a thickness equal to or higher than the predetermined value;

an edge detection unit that decides whether or not the pixel data acquired by said image data acquiring unit includes pixels at an edge region; and

an image output unit that outputs, responsive to the decision of said thickness region decision unit or said edge detection unit, an arrangement of pixels non-periodically when the pixel data includes pixels at a thickness region having a thickness lower than the predetermined value and outputs an arrangement of pixels periodically when the pixel data includes pixels at a thickness region having a thickness equal to or higher than the predetermined value.

24. (New) An image processing apparatus according to claim 23, further comprising:

a dot arrangement decision unit that decides, responsive to the decision of said thickness region decision unit or said edge detection unit, that pixels are arranged non-periodically when the pixel data includes pixels within a thickness region having a thickness lower than the predetermined value and that pixels are arranged periodically when the pixel data includes pixels within a thickness region having a thickness equal to or higher than the predetermined value, wherein

said image output unit outputs, responsive additionally to the decision of said dot arrangement decision unit, the arrangement of pixels decided by the dot arrangement decision unit.

25. (New) An image processing apparatus according to claim 23, further comprising:

a dot arrangement decision unit that decides, responsive to the decision of said thickness region decision unit or said edge detection unit, that pixels are arranged non-periodically when the pixel data includes pixels within a thickness region having a thickness lower than the predetermined value and that pixels are arranged periodically when the pixel data includes pixels within a thickness region having a thickness equal to or higher than the predetermined value;

a periodic dot output threshold storage unit that stores a periodic dot output threshold value when dots are arranged periodically;

a non-periodic dot output threshold storage unit that stores a non-periodic dot output threshold value when the dots are arranged non-periodically;

a threshold matrix selecting unit that selects, responsive to the decision of said dot arrangement decision unit, one of the

periodic dot output threshold value stored in said periodic dot output threshold storage unit and the non-periodic dot output threshold value stored in said non-periodic dot output threshold storage unit;

a periodic dot output diffusion coefficient storage unit that stores a periodic dot output diffusion coefficient when the dots are arranged periodically;

a non-periodic dot output diffusion coefficient storage unit that stores a non-periodic dot output diffusion coefficient when the dots are arranged non-periodically;

a diffusion coefficient selecting unit that selects, responsive to the decision of said dot arrangement decision unit, one of the periodic dot output diffusion coefficient stored in said periodic dot output diffusion coefficient storage unit and the non-periodic dot output diffusion coefficient stored in said non-periodic dot output diffusion coefficient storage unit; and

an error diffusion computing unit that computes an error diffusion from the diffusion coefficient selected by said diffusion coefficient selecting unit and performs binary processing based on the threshold value selected by said threshold matrix selecting unit, wherein

said image output unit outputs, responsive additionally to an output from said error diffusion computing unit, the

arrangement of pixels decided by the dot arrangement decision unit.

26. (New) An image processing apparatus according to claim 25, further comprising:

an error calculation unit that calculates an error produced, when the binary processing is performed, from: (1) binary-processed pixel data calculated by said error diffusion computing unit and (2) the image data acquired pixel by pixel by said image data acquiring unit, wherein

said error diffusion computing unit computes the error diffusion of the image data from: (1) error data calculated by the error calculation unit, (2) the diffusion coefficient selected by said diffusion coefficient selecting unit, and (3) the threshold value selected by said threshold matrix selecting unit.

27. (New) An image processing apparatus according to claim 23, further comprising an edge detection unit that decides whether or not multi-tone image data acquired by said image data acquiring unit includes pixels at an edge region.

28. (New) An image processing apparatus comprising:

an image data acquiring unit that acquires pixel data from image data having a plurality of colors;

a thickness region decision unit that decides whether the pixel data acquired by said image data acquiring unit includes pixels at a thickness region having a thickness lower than a predetermined value or includes pixels at a thickness region having a thickness equal to or higher than the predetermined value; and

an image output unit that outputs, responsive to the decision of said thickness region decision unit, target pixels, relative to pixels adjacent to the target pixels and outputted immediately before the target pixels, with non-periodic time intervals when the thickness region decision unit decides that the pixel data includes pixels at a thickness region having a thickness lower than the predetermined value and outputs the target pixels, relative to pixels adjacent to the target pixels and outputted immediately before the target pixel, with periodic time intervals when the thickness region decision unit decides that the pixel data includes pixels at a thickness region having a thickness equal to or higher than the predetermined value.

29. (New) An image processing apparatus according to claim 28, further comprising:

a dot arrangement decision unit that decides, responsive to the decision of said thickness region decision unit, that the target pixels are arranged relative to pixels adjacent to the target pixels and outputted immediately before the target pixels with non-periodic time intervals when it is decided that the pixel data includes pixels within a thickness region having a thickness lower than the predetermined value and decides that the target pixels are arranged relative to pixels adjacent to the target pixels and outputted immediately before the target pixels with periodic time intervals when it is decided that the pixel data includes pixels within a thickness region having a thickness equal to or higher than the predetermined value, wherein

said image output unit outputs, responsive additionally to the decision of said dot arrangement decision unit, the arrangement of the target pixels decided by the dot arrangement decision unit.

30. (New) An image processing apparatus according to claim 28, further comprising:

a dot arrangement decision unit that decides, responsive to the decision of said thickness region decision unit, that target pixels are arranged relative to pixels adjacent to the target pixels and arranged immediately before the target pixels with

periodic time intervals when it is decided that the pixel data includes pixels within a thickness region having a thickness lower than the predetermined value and decides that the target pixels are arranged relative to the pixels adjacent to the target pixels and arranged immediately before the target pixels with periodic time intervals when it is decided that the pixel data includes pixels within a thickness region having a thickness equal to or higher than the predetermined value;

a periodic dot output threshold storage unit that stores a periodic dot output threshold value when dots are arranged periodically;

a non-periodic dot output threshold storage unit that stores a non-periodic dot output threshold value when the dots are arranged non-periodically;

a threshold matrix selecting unit that selects, responsive to the decision of said dot arrangement decision unit, one of the periodic dot output threshold value stored in said periodic dot output threshold storage unit and the non-periodic dot output threshold value stored in said non-periodic dot output threshold storage unit;

a periodic dot output diffusion coefficient storage unit that stores a periodic dot output diffusion coefficient when the dots are arranged periodically;

a non-periodic dot output diffusion coefficient storage unit that stores a non-periodic dot output diffusion coefficient when the dots are arranged non-periodically;

a diffusion coefficient selecting unit that selects, responsive to the decision of said dot arrangement decision unit, one of the periodic dot output diffusion coefficient stored in said periodic dot output diffusion coefficient storage unit and the non-periodic dot output diffusion coefficient stored in said non-periodic dot output diffusion coefficient storage unit; and

an error diffusion computing unit that computes an error diffusion from the diffusion coefficient selected by said diffusion coefficient selecting unit and performs a binary processing based on the threshold value selected by said threshold matrix selecting unit, wherein

said image output unit outputs, responsive additionally to an output from said error diffusion computing unit, the arrangement of the target pixels decided by the dot arrangement decision unit.

31. (New) An image processing apparatus according to claim 30, further comprising:

an error calculation unit that calculates an error produced, when the binary processing is performed, from: (1) binary-

processed pixel data calculated by said error diffusion computing unit and (2) the image data acquired pixel by pixel by said image data acquiring unit, wherein

said error diffusion computing unit computes the error diffusion of the image data from: (1) error data calculated by the error calculation unit, (2) the diffusion coefficient selected by said diffusion coefficient selecting unit, and (3) the threshold value selected by said threshold matrix selecting unit.

32. (New) An image processing apparatus according to claim 28, further comprising an edge detection unit that decides whether or not multi-tone image data acquired by said image data acquiring unit includes pixels at an edge region.